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FOREST PEST MANAGEMENT

3430 BIOLOGICAL EVALUATION
R2-83-1

DIPLODIA TIP BLIGHT OF PONDEROSA PINE
IN THE BLACK HILLS, SOUTH DAKOTA

United States
Department of
Agriculture

Forest Service

Forest Pest Management
Denver, Colorado

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DIPLODIA TIP BLIGHT OF PONDEROSA PINE IN THE BLACK HILLS, SOUTH DAKOTA

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EXPERIMENT STATION

INTRODUCTION

Diplodia tip blight, incited by *Diplodia pinea* (Desm.) Kickx, was first reported on ponderosa pine (*Pinus ponderosa* Laws.) in the Black Hills of South Dakota during July 1979 (3). This was the first known report of extensive infection of native stands of ponderosa pine. Other reports of the disease from around the world concern infection of introduced pines in plantations or shelterbelts. The fungus causes death of current-year shoots, major branches, and ultimately entire trees (7).

During 1980-1982, additional surveys were conducted to determine the distribution of the disease throughout the Black Hills and to evaluate the potential impact of the disease on tree growth and survival (4,5). This report summarizes work conducted since 1979.

METHODS

Field examinations of symptomatic ponderosa pines were conducted along major highways throughout the Black Hills in 1979-1982 during June-August. Necrotic tissues, including cone scales, twigs, needles and dead buds from symptomatic trees, were examined for fungal fruit bodies. In addition, second-year cones were collected in areas where trees were free of shoot infection to determine if *D. pinea* colonizes older cones and is a common saprophyte as well as parasite of ponderosa pine in the Black Hills.

Tissue samples, including needles, buds and cones, were collected from symptomatic trees throughout the Black Hills. The samples were cultured to confirm the identity of the causal agent. Positive identification was based on the presence of both pycnidia and spores typical of *D. pinea*.

Photo plots were located in two areas to follow progress of disease symptoms over several seasons and to determine short term effects of *D. pinea* on tree vigor and survival. Data recorded for trees included d.b.h., age, presence of cones, and disease rating. The disease rating was a modification of that used for dwarf mistletoe (2).

The crown was divided into thirds and each third rated as heavy, light, or non-infected. Disease ratings were recorded in 1980, 1981, and 1982 and compared. To determine the effect of the disease on tree vigor, increment cores were taken at d.b.h. on opposite sides of each tree and the increment was measured for the last five and ten years.

In order to investigate the probable sudden appearance of the disease in 1979, weather data collected approximately 18 air miles northwest of Rapid City, from 1975 to 1980 was compared.

RESULTS AND DISCUSSION

Diplodia pinea was confirmed in several locations scattered throughout the Black Hills (Figure 1). The disease was primarily along the eastern half of the Black Hills east of Custer extending from Sturgis to Hot Springs.

The best indication of *D. pinea* infection was the presence of pycnidia on cone scales. The disease appeared most damaging on open-grown trees with numerous cones. Affected trees were located mostly in openings and along the edge of stands. Severely affected trees had numerous dead branches. Tree mortality was uncommon. The fungus was not found on cones in any areas where trees were free of shoot infection.

Individual tree infection varied greatly (from a rating of 0 to 6) as evidenced by trees in the photo plots (Table 1). When individual tree ratings were summed and compared, the severity of infection was somewhat reduced in 1982 over 1980 (Table 1). A visual comparison of trees (see Figures 2-13) shows considerable improvement in tree appearance in 1982.

When increment cores of all trees in the photo plots were compared and the total increment (mm) summed for the last ten years, a 20 percent reduction in growth was noted in the last five years compared to the previous five years. However, when the growth of trees with a rating of 0 in 1980 were compared to all other trees there was no significant difference between growth in the last five years compared to the previous five years. This anomaly may relate to a delayed growth response to infection.

An examination of weather data over the six year period (Table 2) showed that total rainfall in May 1978, (9.07 inches), was significantly higher than the average for all other years (2.63 inches) (Table 2). This unusually high rainfall during growth of buds, shoots and cones would be highly favorable for spore production, spread and infection of susceptible tissues (1,6, 7). Obvious symptoms of infection appeared the following spring (1979), the year in which the first report of the disease in the Black Hills was made (3). Low winter temperatures in 1978-79 may also have increased tissue susceptibility to infection.

The scattered nature of the disease throughout the Black Hills suggests the fungus is not a recent introduction, but may be native. Unusually high rainfall in the spring prior to the first report of the disease appears to have played a role.

At this time the disease does not appear to be increasing in severity on trees observed over a 3 year period or spreading into new areas in the Black Hills. In fact, symptoms have declined since 1979. This situation may change in the future if conditions favorable for the disease reappear.

Since the disease is more severe on open-grown trees with large cone crops, it poses little threat to most established stands. Infection was not detected in managed, fully stocked stands thus changes in current silvicultural practices are not necessary at this time. High value trees in developed recreation sites and around homesites can be protected by application of chemical sprays if warranted (6, 7).

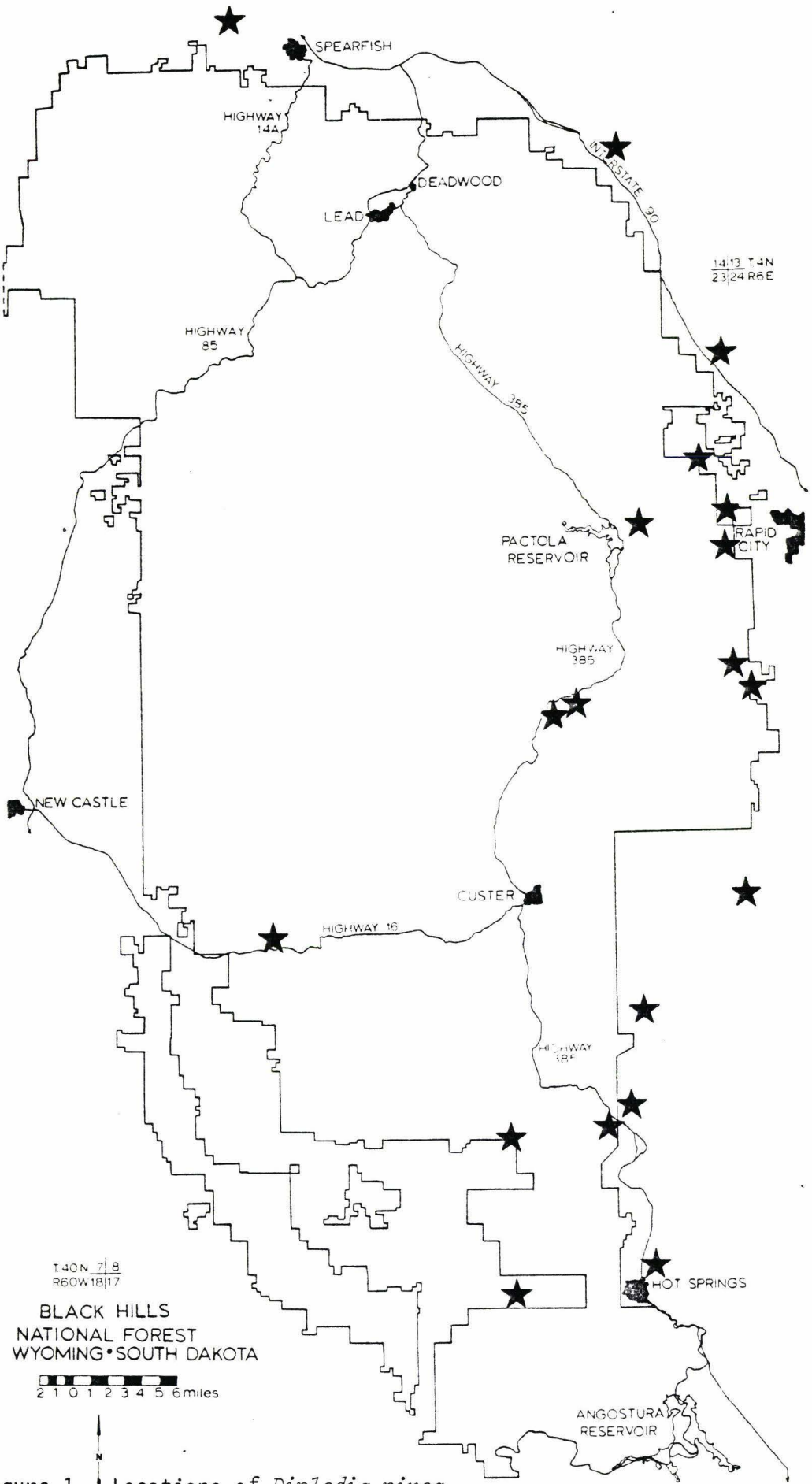

Figure 1. Locations of *Diplodia pinea* infected ponderosa pine in the Black Hills, South Dakota (1979-82).

Table 1. Descriptions of ponderosa pines in photo plots, Black Hills, South Dakota 1980-1982.

Location	Tree No.	Tree Age (yrs.)	Tree d.b.h. (inches)	Disease Rating (Year)		Growth Increment (mm)	
		1980	1980	1980	1982	Last 5 Years (1976-81)	Last 10 Years (1971-81)
Pennington County	1	85	23.3	6	6	7	20
"	2	75	17.0	4	3	7	20
"	3	72	14.0	3	3	5	15
"	4	80+	23.2	6	6	6	13
"	5	80+	26.5	0	2	5	14
"	6	69	15.8	0	0	10	24
"	7	110	20.1	6	6	2	6
Rockerville	1	74	20.2	6	3	15	27
"	2	63	16.2	5	3	9	29
"	3	75+	17.4	0	2	6	14
"	4	78	13.5	2	1	12	28
Totals	-	861	207.2	38	35	84	210
Average	-	78.3	18.8	3.4	3.2	7.6	19.1

Table 2. Maximum and Minimum Temperature[1/] and Precipitation[2/] by Month from 1975 to 1980 on the Experimental Forest in the Black Hills of South Dakota

		J	F	M	A	M	J	J	A	S	O	N	D
1975	Max	37.6	45.3	48.4	56.3	68.6	75.3	84.8	88.8	80.0	75.2	62.8	47.2
	Min	-3.4	-10.5	5.4	14.5	28.8	35.5	42.0	40.8	27.6	20.0	7.3	3.7
	ppt	1.63	.88	2.56	3.08	3.82	5.85	1.67	.95	.08	1.31	.70	2.31
1976	Max	39.0	51.6	54.2	62.4	73.6	75.8	84.6	81.8	83.8	66.3	56.6	44.0
	Min	-7.2	10.0	8.0	23.8	27.8	35.7	41.4	43.4	28.4	10.3	5.0	-2.6
	ppt	.56	1.21	1.08	4.25	2.60	6.95	3.30	1.92	1.63	.56	.30	2.40
1977	Max	37.6	49.3	51.3	63.4	75.8	86.0	85.4	82.3	79.2	70.8	64.3	48.0
	Min	-10.0	17.8	15.3	17.0	31.0	35.4	37.8	33.5	26.2	18.8	12.7	-8.7
	ppt	1.88	1.34	2.18	5.58	2.17	3.47	2.11	2.19	2.28	2.09	1.46	.92
1978	Max	45.0	45.0	56.6	62.3	74.5	81.8	85.5	85.5	85.4	74.6	57.3	38.6
	Min	-13.5	-7.8	0.0	14.0	28.5	27.4	38.3	28.5	29.2	13.6	-3.0	-5.8
	ppt	.52	1.32	.87	1.93	9.07	2.46	3.54	1.47	2.54	1.08	1.31	1.35
1979	Max	34.8	46.0	53.8	54.6	67.8	79.0	80.2	83.0	85.5	70.8	52.0	57.8
	Min	-20.5	-14.5	-1.3	12.0	19.8	27.6	39.2	33.8	24.3	20.4	2.6	2.8
	ppt	.63	.82	.64	2.22	1.54	4.28	4.13	3.77	.66	.67	1.65	.33
1980	Max	37.4	48.0	51.0	62.2	73.2	83.3	91.4	85.5	80.2	69.0	58.8	54.2
	Min	-.8	-16.2	-3.0	9.3	12.6	31.3	31.4	27.5	19.2	12.5	-2.0	-4.6
	ppt	.92	.72	1.18	2.58	3.03	3.19	1.04	2.78	1.52	1.96	.87	1.13

1/ Temperature (Degrees Fahrenheit)

2/ Precipitation (Inches)

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